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Cover photo In 2026, the centennial anniversary of the naming of Penglai rice coincides with the 25th anniversary of the release of Yi-Chuan Fragrant Rice. Over the past century, the Taiwan Agricultural Research Institute has aligned its breeding efforts with evolving agricultural policies. The focus of varietal development has progressed from high-yield production to functional traits, and more recently to resilience to environmental stresses. Each generation of varieties reflects the agricultural priorities of its time.
In recent years, in response to the growing emphasis on ecological sustainability, regions across Taiwan have introduced branded rice products incorporating wildlife-friendly concepts, demonstrating the integration of agricultural production with environmental stewardship.

Published in May, 2026

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Foreword from the Director General

The Taiwan Agricultural Research Institute (TARI), founded 130 years ago, has consistently adhered to the guiding principle of "agricultural innovation led by science and technology." It has played a leading role in advancing agricultural technologies, while continuously deepening related research and cultivating innovative and mission-driven research talent.

In 2025, TARI implemented a total of 220 research projects (including 20 projects originally undertaken by the former Floriculture Experiment Branch), with significant and demonstrable outcomes. In addition to achieving its research objectives, TARI has been ranked as the top subordinate research institution under the Ministry of Agriculture for three consecutive years. The pineapple export promotion team led by the Chiayi Agricultural Experiment Branch received the National Agricultural Science Distinguished Team Award (Industry Leadership Category) in recognition of its outstanding cross-agency collaboration. Furthermore, the Fengshan Tropical Horticultural Experiment Branch received the Technological Innovation Award at the 4th IPM Awards for its application of green LED night lighting to control litchi fruit borer, reducing damage rates from 70% to below 5%. This technology has subsequently been extended to the green onion industry.

In response to global trends in climate change and sustainable development, innovation and application of agricultural technologies have become critical to enhancing the competitiveness and transformation of Taiwan's agricultural sector. In 2025, TARI licensed 11 new technologies, including: soybean flavor powder production through fermentation and aging; mass production of *Claroideoglomus etunicatum*; smart crop drying technology; growth simulation systems for indeterminate large-fruited tomatoes; frozen ready-to-serve dried sweet potato products; integrated greenhouse environmental sensing and control systems; non-exclusive insect trap technology; frozen pre-cooked green banana and banana puree processing technologies; green onion washing machines; and reproductive technology for rice variety 'Tainung No. 88'.

TARI also licensed plant variety rights for two new cultivars: anthurium 'Tainung No. 11–Purple Garden' and Oncidium

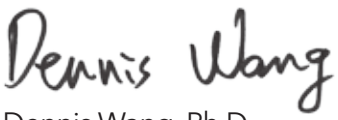
'Tainung No. 9–Green Fragrance', both of which were subsequently transferred to the Floral Industry Innovation Center following the integration of the Floriculture Experiment Branch. In addition, four new plant varieties were granted domestic rights, including Oncidium 'Tainung No. 13–Green Giant', peanut 'Tainung No. 11', sugar apple 'Tainung No. 1–Green Jade', and grape 'Tainung No. 2–Jade'. One new baby corn variety, 'Tainung No. 9–Fine Way', was officially named. Internationally, litchi varieties 'Tainung No. 6–Colorful Litchi' and 'Tainung No. 7–Early Big' were granted plant variety rights in Australia.

TARI also obtained four patents, covering a plant fiber extracting system, a positioning system having switchable positioning devices, an automated field record checking system using low-power positioning beacon combined with communication software, and an insect trapping device. These intellectual property achievements not only represent research outputs but also facilitate the transformation of knowledge into practical applications for farmers and agribusinesses. In 2025, TARI completed 31 cases of agricultural technology transfer and licensed 41 technologies to 46 enterprises or farmers, generating licensing fees of NT$4.02 million and royalties of NT$863,000.

Following my assumption of office in July 2025, TARI has actively promoted international collaboration. From September 1 to 3, TARI collaborated with the Food and Fertilizer Technology Center (FFTC), Japan's National Agriculture and Food Research Organization (NARO), and the African-Asian Rural Development Organization (AARDO) to host an international workshop on "Unlocking Agrifood Innovation." On September 17, TARI co-organized the "2025 International Workshop on Precision Crop and Pest Management" with NARO. From October 21 to 23, TARI again partnered with FFTC to host a workshop on sustainable low-carbon rice production technologies. Additionally, on September 5, TARI invited Dr. Simon Liu, former Administrator of the U.S. Agricultural Research Service, to deliver a keynote address on the application of artificial intelligence in agricultural technology.

In alignment with Taiwan's Food and Agricultural Education (FAE) policy, TARI has initiated plans to transform the Guangfu Medicinal Herb Garden into an FAE demonstration park. The Agricultural Technology Translation Center is expected to integrate research outcomes across institutions to showcase the multifunctionality of agriculture. In addition, the Activated Isolation Greenhouse of the Applied Zoology Division is being developed into a facility for mass insect production to support circular agriculture. The Agricultural Chemistry Division has also collaborated with the Hualien District Agricultural Research and Extension Station to promote drip irrigation in organic farming and assist in agricultural recovery in disaster-affected areas in Guangfu Township, Hualien County.

This year marks the 25th anniversary of Yi-Chuan Fragrant Rice and the 100th anniversary of the naming of Penglai rice. Reflecting on the past 130 years, TARI has advanced Taiwanese agriculture through systematic scientific research, beginning with paddy rice studies. Looking ahead, TARI will continue to promote interdisciplinary collaboration, technological integration, and cross-institutional partnerships to strengthen its research support systems and innovation platforms. It is anticipated that all colleagues will continue to embrace challenges, make effective use of institutional resources, and contribute their expertise to further enhance agricultural innovation.



Dennis Wang, Ph.D.

May, 2026

Major Events in 2025

01 JANUARY

January 7 – Symposium on Research and Development of Smart Agriculture and Biomechatronics Engineering

02 FEBRUARY

February 13 – Taiwan Ecological Research Network-Long-Term Social-Ecological Research Joint Conference

03 MARCH

March 18 – Business matchmaking meeting and press conference for 2024 agricultural technology research achievements

05 MAY

May 13 – 2025 Taiwan-Netherlands Bilateral Conference on Greenhouse Horticulture and Phenotyping Applications

May 28 – Press conference for the 70th anniversary of sweet potato 'Tainung No. 57'

06 JUNE

June 12 – Press conference on green LED night lighting technology for pest control and increased green onion production

June 23 – 2025 International Symposium on Novel Control Technologies of Crop Pests and Diseases

07 JULY

July 1 – Press conference on innovative cultivation methods for healthy ginger production

July 9 – Forum on genetic resources exchange and advanced breeding strategies

09 SEPTEMBER

September 1 – Integration of the Floriculture Experiment Branch into the Floral Industry Innovation Center

September 5 – Visit by Dr. Simon Liu, former Administrator of the U.S. Department of Agriculture's Agricultural Research Service

September 17 – 2025 TARI–NARO International Workshop on Precision Crop and Pest Management

10 OCTOBER

October 21 – 2025 Workshop on Regional Landscapes of Sustainable Rice Production: Integrated Low-Carbon Technologies and Business Innovations

October 22 – International Conference on Agricultural Spatial Information Applications

11 NOVEMBER

November 19 – Conference on Germplasm Collection and Variety Protection

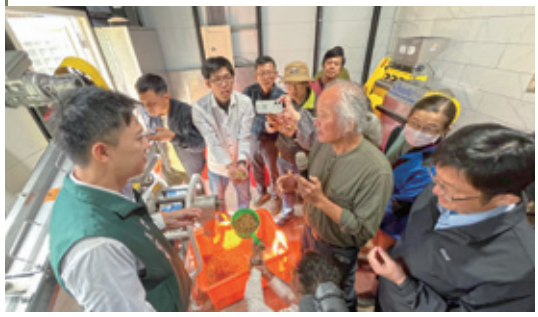
November 22 – 130th Anniversary of TARI

12 DECEMBER

December 2 – Press conference on rice 'Tainung No. 88'

December 12 – Exhibition on portable solar panel applications in smart greenhouses

December 15 – Demonstration and press conference on mechanized coffee operations



Featured New Varieties of 2025

‘Su19’: A New Heat- and Disease-Resistant Green Onion Breeding Line

The ‘Su19’ is a high-quality year-round green onion variety. The plant is upright, produces numerous tillers, is early-maturing and highly heat-resistant. It provides a high yield per unit area and has a rich taste. Disease resistance evaluations indicate that it has resistance to soft rot disease, phytophthora blight, and anthracnose-twister disease. Characterized by high productivity, heat-resistance, and disease-resistance, it demonstrates strong market potential.

Tomato 'Tainung No. 3'

Through molecular marker-assisted selection (MAS) and pathogen inoculation verification, TARI has developed a new tomato variety, 'Tainung No. 3'. This variety exhibits resistance to major soil-borne diseases, including bacterial wilt, *Fusarium* wilt, and root-knot nematodes.

It serves as an excellent parental line for F_1 hybrid rootstocks used in large-fruited tomato production. An application for plant variety protection (PVP) has been filed, and technology licensing to the industry is currently in progress.

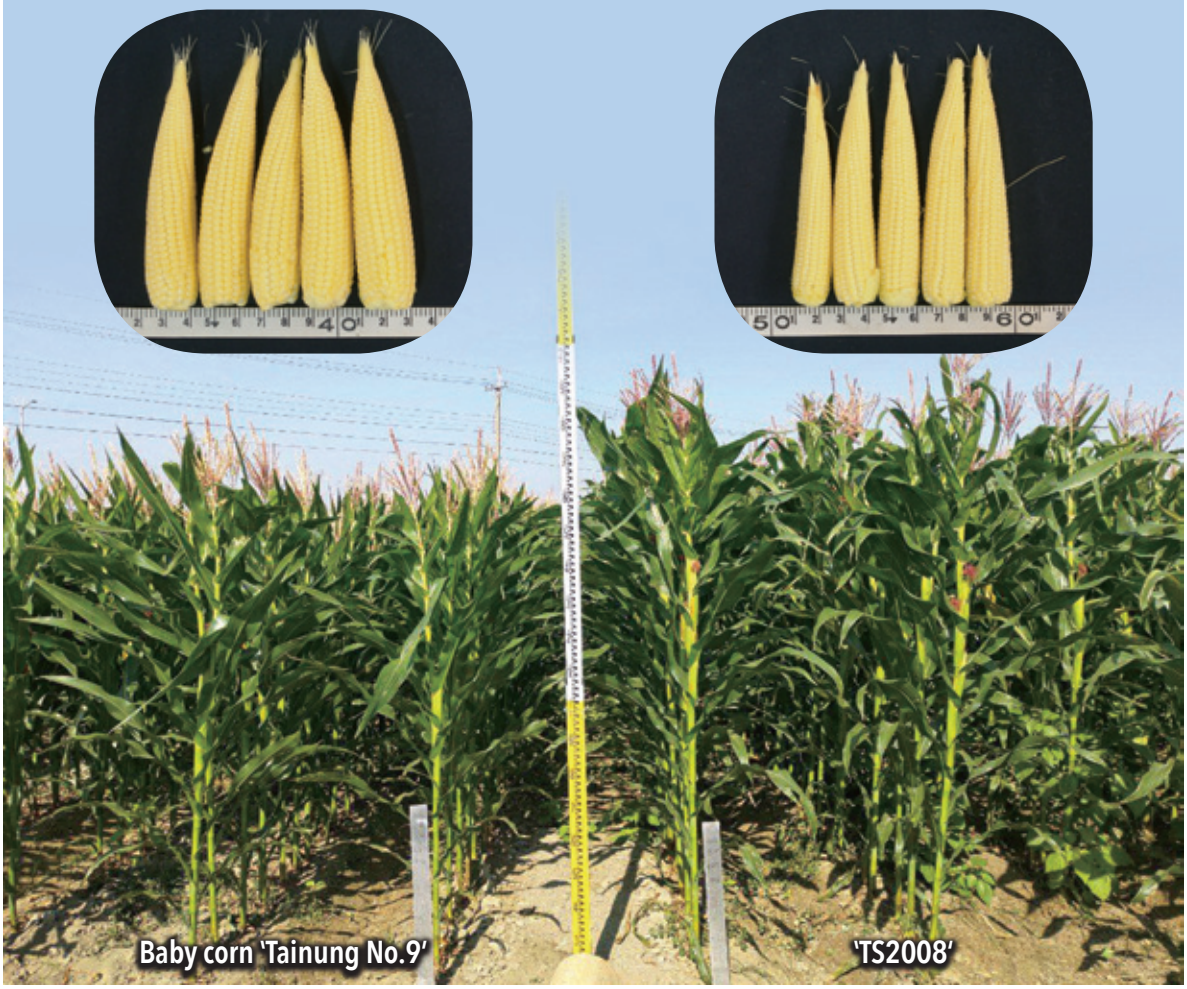
Baby Corn 'Tainung No. 9-Fine Way'

This variety was specifically developed for baby corn production under moderately dry and high-temperature conditions. It has a short growing period, requiring approximately 60–65 days from sowing to harvest.

The plants are characterized by slender, upright leaves and produce multiple ears. The anthers and silks are both red. The baby corn ears are short, thick, and conical in shape.

The variety exhibits desirable quality traits, including a tender texture, excellent flavor, and attractive color. It also has a high edible yield and a low husk proportion, making it well suited for pre-husked packaging and contributing to reduced agricultural waste.

These advantages enhance its suitability for processing and commercial production.



Grape 'Tainung No. 2-Jade'

For the grape variety 'Tainung No. 2–Jade', bud burst occurs early. Shoot tips are densely covered with hairs, and anthocyanin coloration is absent or very weak. Young leaves are green on the upper surface, with a moderate density of hairs on the underside. The dorsal side of the internodes is green with red coloration. The onset of berry ripening is early to medium.

The berries have yellow-green skin and a rich aroma. Compared with 'Italia', a representative green-skinned grape variety, 'Tainung No. 2–Jade' produces larger fruit, matures earlier, and exhibits greater disease resistance.

Overall, 'Tainung No. 2–Jade' demonstrates excellent performance and strong market potential.

Outstanding New Agricultural Technologies for 2025

1 Advanced Technologies for Pest and Disease Management in Export Pineapples

This initiative includes the development of ecological monitoring techniques for the Cosmopterigid moth; the registration of selected chemical control agents and the establishment of safe pre-harvest intervals for the control of the Cosmopterigid moth, mealybugs, and fruitlet core rot; and the application of fludioxonil for the prevention of pedicel mold and rot. The latter is implemented in combination with alcohol treatment and air-drying to ensure compliance with the phytosanitary requirements of Japan and other export markets.

1

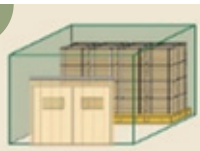
Strengthen field management

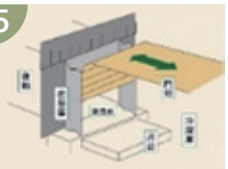
2

Strengthen the cleaning operation of each fruit individually

3

Packaging work area enclosed

4

Cardboard box storage space is enclosed

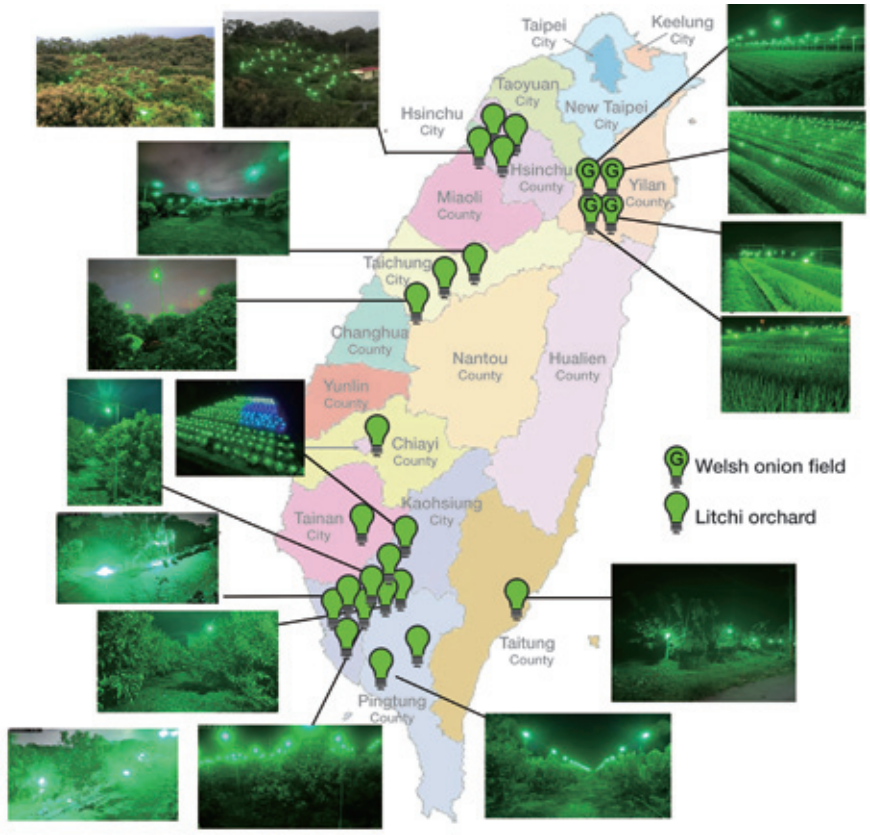
5

To maintain the cold chain, the finished product warehouse connects directly to export containers via dock shelters and seals

6

Insect control measures are required for nighttime operations

2 Green LED Night Lighting for Effective Pest Control

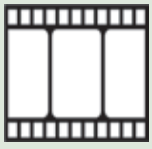
This technology exploits the biological characteristics of the litchi fruit borer and the beet armyworm, which are nocturnal pests that become inactive at sunrise. By applying filtered green LED wavelengths, the system suppresses insect activity and reduces their energy levels. When deployed at night, the green light induces a daytime resting state in these pests, thereby significantly reducing crop damage and reliance on chemical pesticides.



3 Digital Technologies for Greenhouse Cultivation of Large-Fruited Tomatoes

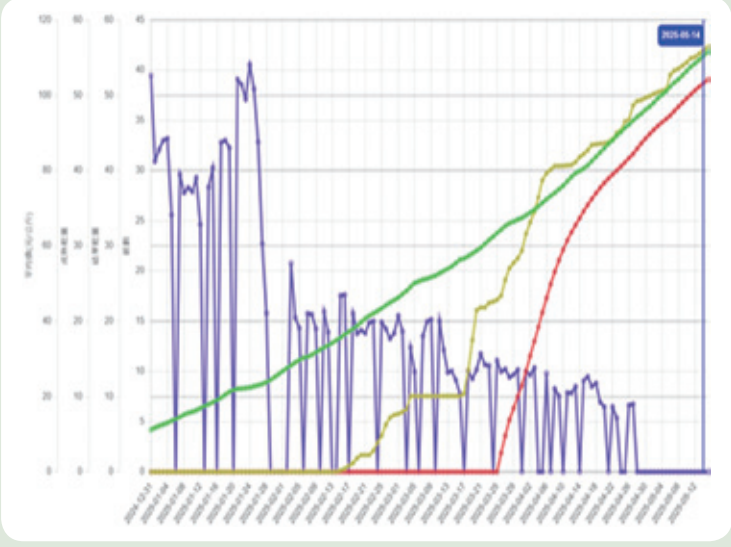
By automatically capturing greenhouse environmental data through a cloud-based digital demonstration platform and utilizing handheld video recordings of tomato growth, the system enables simulation-based forecasting of growth and yield, as well as real-time assessment of fruit set. It provides reliable decision-making support for the large-fruited tomato value chain, thereby accelerating the development of data-driven smart agriculture.

Handheld mobile phone



Video

Cloud image analytics output



4 Research and Development for Upgrading the Ginger Value Chain

Healthy seed rhizomes (seed ginger) for planting are produced from tissue-cultured ginger plantlets using off-ground cultivation systems in lowland facilities. This technology overcomes the previous limitation of a two-year production cycle required for generating healthy seed rhizomes through conventional tissue culture methods, reducing the production period to one year while achieving yields comparable to those of conventional cultivation.

In addition, the technology effectively reduces production costs and enhances the feasibility of field-level application.

Tissue culture ginger seedlings

2 months

Acclimatized ginger seedlings

2 months

Off-ground cultivation in the lowlands

8 months

Medium-mature ginger (Can be used as ginger seed)

5 Development of an Improved Methodology for Agricultural Soil Management

This methodology integrates a range of field management practices, including the application of organic materials, reduced tillage, the return of crop residues to the soil, grass cover cultivation, and the planting of green manure during fallow periods. It emphasizes the role of increased soil organic carbon in enhancing soil quality and ecosystem functions.

The methodology is intended to serve as a reference for the expansion of soil carbon sequestration practices in the agricultural sector and as a scientific basis for carbon sink accounting.

6 Technologies for the Recycling, Decomposition, and Sustainable Utilization of Residual Substrates from Mushroom Cultivation Using Yellow Mealworms

This technology utilizes the high-efficiency consumption and bioconversion capacity of the yellow mealworm to decompose residual substrate generated during mushroom cultivation and convert it into value-added bioproducts.

It supports the circular utilization of agricultural residues while reducing material waste and promoting environmental sustainability.

7 A Resilient Farming Method for Stabilizing Summer and Autumn Green Onion Production

Green onions can be successfully cultivated throughout the summer and autumn seasons using a seven-element framework: seed (healthy seedlings), field (site selection), fertilizer (rational nutrient management), water (appropriate irrigation), management (cultivation practices), pesticides (precision application), and agricultural inputs (effective control agents).

This comprehensive technical framework, referred to as the "resilient farming method for green onions," serves as a core strategy for stabilizing production under high-temperature and flood-prone conditions.

8 Technologies for the Development and Application of Green Onion Washing Machines

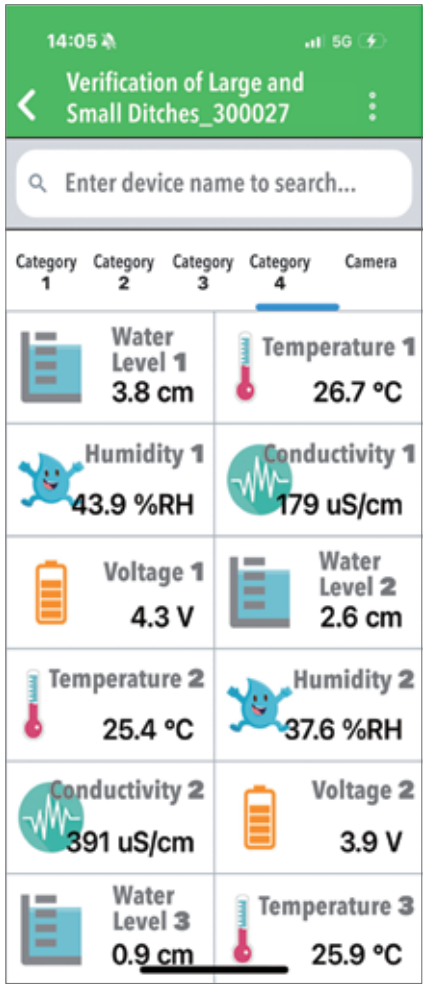
These machines operate based on the twin-fluid nozzle internal mixing principle, in which high-velocity air is used to atomize incoming liquid and reduce droplet size. This process generates a high-velocity spray with fine droplets, enabling the effective removal of adhered soil and senescent yellow leaves from the roots of green onion plants.

9 An Optimized Irrigation Module for Central Taiwan

This model focuses on the development of an irrigation monitoring system integrated with an optimized irrigation module for alternate wetting and drying (AWD) management in rice cultivation.

For upland crops such as maize and sweet potato, irrigation scheduling is supported by parameters including crop coefficients (Kc), which represent crop water requirements, and evapotranspiration (ET). Irrigation volumes are continuously adjusted based on real-time field conditions.

This precision irrigation approach enhances water-use efficiency and provides decision support for deficit irrigation strategies.



Doppler flow meter

Ultrasonic water level sensor

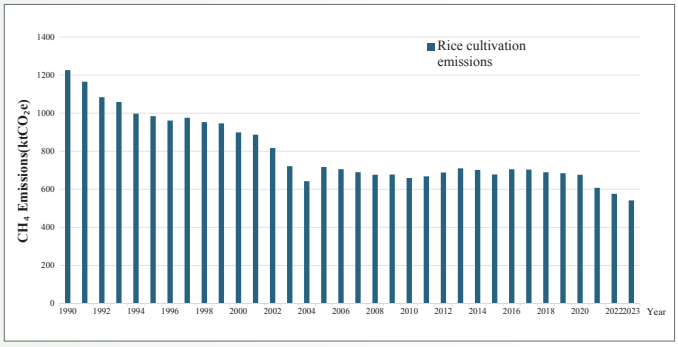
Paddy field water level sensor

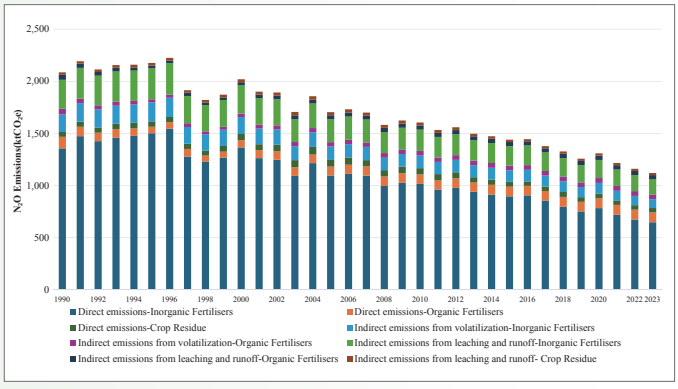
Parshall flume flow meters

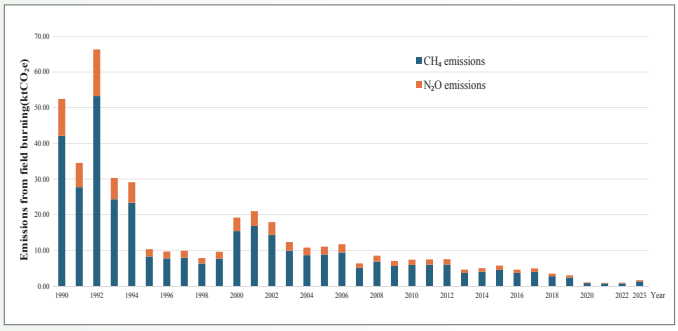
10 Estimation of Greenhouse Gas Emissions from Crop-Related Sources in Taiwan's Agricultural Sector

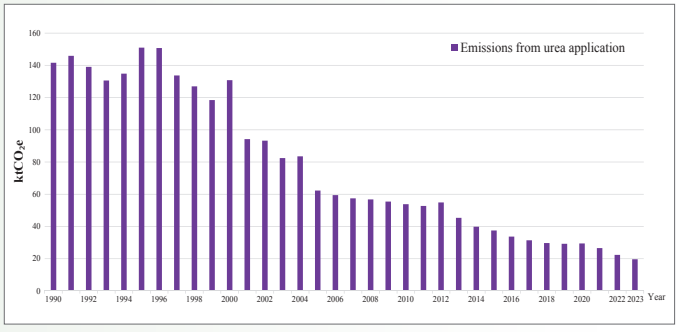
This study estimates annual greenhouse gas emissions from selected crop-related sources in Taiwan's agricultural sector over the period 1990–2023, including rice cultivation, agricultural soils, crop residue burning, and urea application.

Emission factors were updated in accordance with the 2019 Refinement to the 2006 Guidelines of the Intergovernmental Panel on Climate Change (IPCC).




N_2O Emissions($ktCO_2e$)
Direct emissions-Inorganic Fertilisers
Direct emissions-Organic Fertilisers
Direct emissions-Crop Residue
Indirect emissions from volatilization-Inorganic Fertilisers
Indirect emissions from volatilization-Organic Fertilisers
Indirect emissions from leaching and runoff-Inorganic Fertilisers
Indirect emissions from leaching and runoff-Organic Fertilisers
Indirect emissions from leaching and runoff- Crop Residue





New Services

A Dynamic Platform for High Spatiotemporal-Resolution Climate Reconstruction Data

This system utilizes high spatiotemporal-resolution climate reconstruction data provided by the Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP), covering more than 40 years at a spatial resolution of 2 km across over 10,000 grid points.

The platform integrates nine key meteorological variables, including precipitation, temperature, solar radiation, wind speed, relative humidity, and atmospheric pressure. Precipitation thresholds are categorized into daily and cumulative precipitation to accommodate the requirements of different crops and types of agricultural disasters.

Users can define compound weather conditions, including concurrent and sequential scenarios, enabling analyses that more accurately reflect the processes underlying agricultural disaster formation.

The platform also provides immediate access to a range of visualization outputs, including historical trend maps and frequency analyses of threshold exceedance.

It significantly reduces the time required for data integration and processing, thereby improving analytical efficiency.

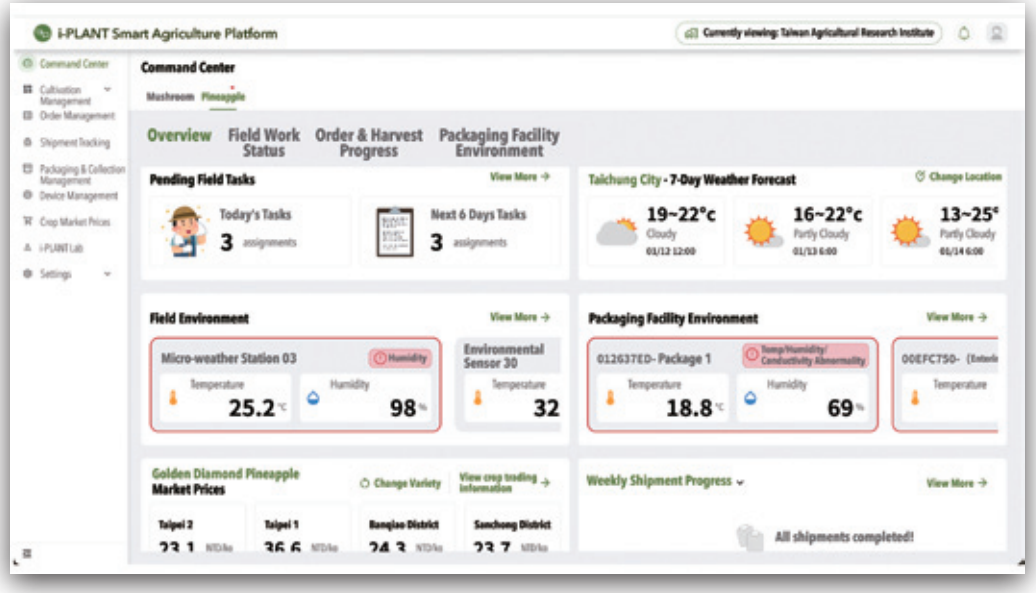
Through continuous development, the platform has evolved from the analysis of single weather variables into a specialized analytical system capable of simulating compound disaster-generating factors. It is now more closely aligned with the practical needs of meteorological research, disaster risk assessment, and climate adaptation planning.

The i-PLANT Smart Agriculture Platform

This platform serves as an automated system for calculating carbon emissions from agricultural machinery. By integrating total operational mileage and fuel consumption data derived from real-time kinematic (RTK) tracking records, the system enables precise estimation of carbon emissions, providing agribusinesses with real-time data to support future carbon footprint verification.

During seed sowing and harvesting periods, the system is estimated to reduce data integration time by approximately 20–30 minutes per day.

In addition, enhanced land information map visualization enables the simultaneous display of basic data and operational progress for individual land parcels. This functionality significantly reduces the time required for user queries and progress comparisons (from approximately three to five minutes) and improves the efficiency of land-use planning.

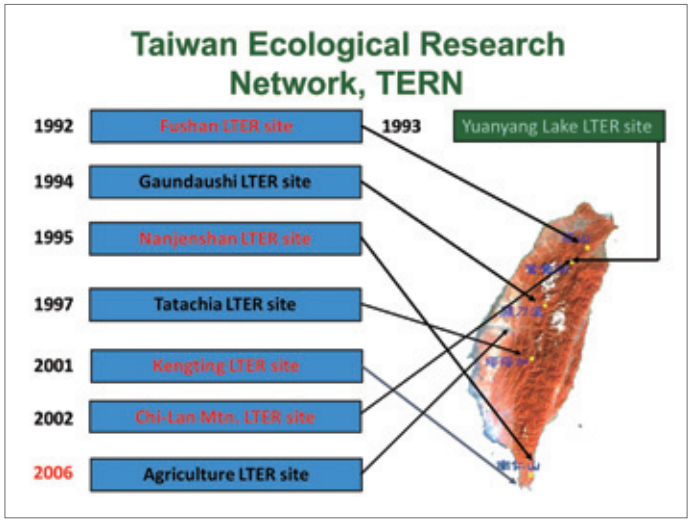


Feature Story

Sustainable Agriculture and Dr. Chi-Ling Chen

Soil is the foundation of agriculture. However, in the past, the intensive use of agrochemicals to increase production led to soil acidification and environmental pollution. To address these issues, TARI established the Agro-Environmental Protection Laboratory within the Agricultural Chemistry Division in 1981. The Laboratory initially focused on air pollution and subsequently expanded its research to include water and soil pollution, as well as the reuse of agricultural and industrial by-products. In recent years, its research scope has further extended to long-term ecological studies of agricultural ecosystems.

Dr. Chi-Ling Chen received her Ph.D. in Soil Science from National Chung Hsing University in 1985 and joined the Agricultural Chemistry Division of TARI in 1986. Her research has focused on heavy metal residues in soils, groundwater quality monitoring and pollution prevention, the reuse of livestock waste on farmland, long-term agro-ecosystem ecology, carbon and nitrogen cycling (sequestration) in farmland, low-carbon agriculture, and the assessment of management practices and ecosystem service values in agro-ecological landscapes of Indigenous communities.



In response to the increasing challenges posed by climate change, biodiversity loss, and food security, TARI launched the Long-Term Agro-Ecosystem Research (Agro-LTER) Program in 2006. The Program integrates expertise from agriculture, soil science, ecology, and meteorology to establish a scientific framework for long-term monitoring and analysis of agricultural environments. The Program aligns with the United Nations Sustainable Development Goals and has enhanced Taiwan's role in the global long-term ecological research network, transitioning from an information consumer to a knowledge contributor in the subtropical region. Since its inception, the Agro-LTER Program has progressed from initial development to a mature and internationally connected research network. Drawing on the experience of the U.S. LTER Network and the International LTER Network, the Program established five core research stations in its early stage and has since expanded. As of 2025, a total of 20 research stations have been established, covering diverse agro-ecosystems, including paddy fields, orchards, tea plantations, and aquaculture systems. The Program has also developed an ecological atlas of Taiwan's agricultural environments.

Over a research career spanning four decades, Dr. Chi-Ling Chen has contributed to a wide range of research areas. She has demonstrated sustained commitment to interdisciplinary research through continuous knowledge acquisition, team coordination, resource integration, and the implementation of research projects.

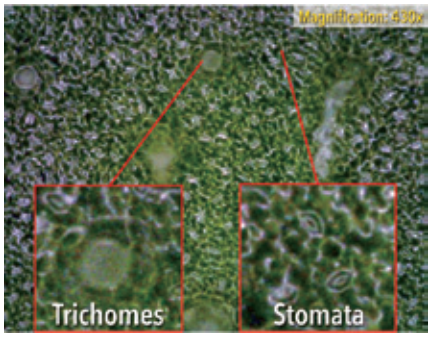
International and Academic Cooperation

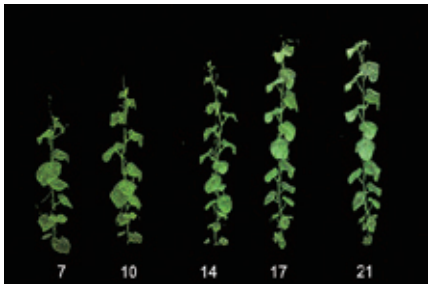
In 2025, TARI continued to align with the Ministry of Agriculture's policy of promoting international engagement through bilateral conferences and cooperation agreements. TARI actively conducted technical exchanges and collaborative activities with overseas academic and research institutions.

During the year, TARI organized seven international conferences addressing key topics, including: (1) climate change adaptation and mitigation strategies for tropical fruit; (2) novel preventive technologies for crop diseases and insect pests, as well as applications of insect resources; (3) agri-food innovation from sensor technologies to smart agriculture; (4) precision management of crops and pests through collaboration between Taiwanese and Japanese agricultural research institutions; (5) low-carbon and sustainable paddy rice cultivation in the Asia-Pacific region; (6) applications of

2025台日農業研究機構作物及害物精準管理國際學術研討會
2025 TARI-NARO International Workshop of Precision Management on Crops and Pests
國際會議廳

2025 International Symposium on Novel Control Technologies
of Crop Pests and Diseases and Application of Insect Resource





agricultural spatial information; and (7) guidance for fruit farmers in adapting to climate change.

Among these events, the "2025 TARI–NARO International Workshop on Precision Management of Crops and Pests" marked the first institutional-level academic collaboration jointly organized by TARI and Japan's National Agriculture and Food Research Organization (NARO). In addition, TARI supported 30 researchers in attending 10 international academic conferences, thereby strengthening international academic exchange.

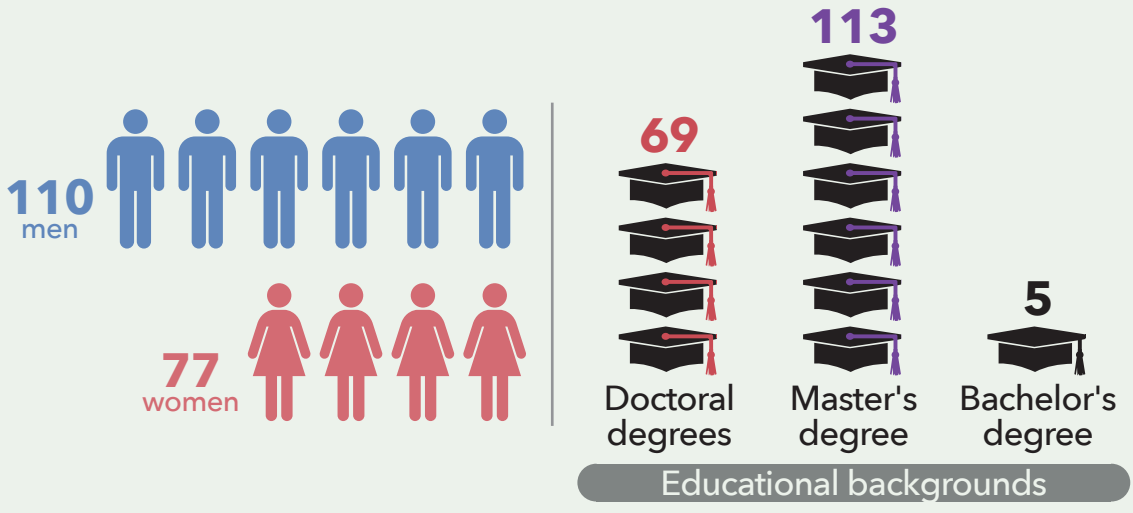
TARI also continued to promote cross-disciplinary and forward-looking academic cooperation with National Taiwan University, National Chung Hsing University, National Yang Ming Chiao Tung University, and National Chiayi University. Under this collaboration framework, universities focused on core technology development and theoretical research, while TARI contributed its strengths in technology integration and field validation through demonstration sites, creating a synergistic effect.

In 2025, a total of 18 collaborative projects were implemented. These included the development of a digital twin model for muskmelon production using cyber-physical systems and AI-based phenotyping technologies; the development of dsRNA-based biopesticides for the prevention of tomato leaf curl virus; investigations into the effects of fermented and unfermented bee pollen on the growth performance and gut microbiota of yellow mealworms; and the application of high-resolution mass spectrometry to analyze complex flavonoid glycosides in tender jute leaves. These projects have generated significant research outcomes.

Resource Introduction of TARI

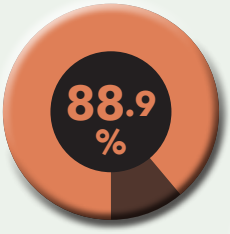
Human Resources

In 2025, TARI's research and development workforce comprised a total of 187 personnel.



$ Budget

In 2025, TARI's total budget amounted to NT$1.393 billion.

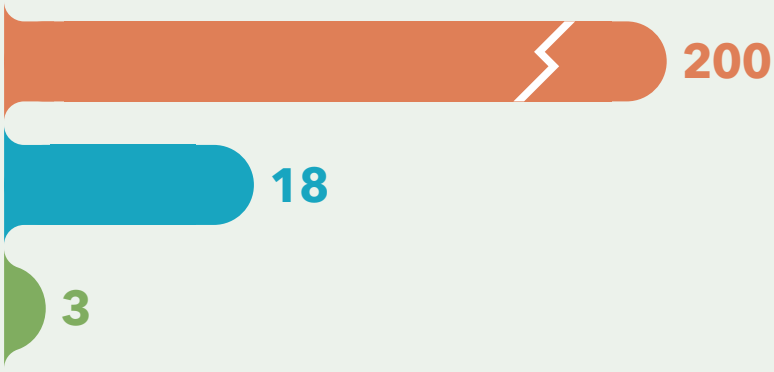


NT$1.238 billion from the government budget

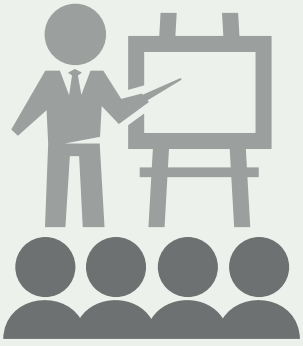
NT$140 million from commissioned research projects

NT$15 million from projects subsidized by the National Science and Technology Council

Research Projects



Innovation Incubation Center



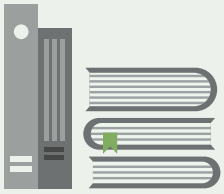
9 Newly incubated enterprises

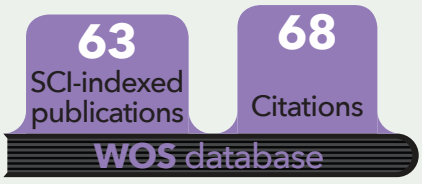
Guiding **20** enterprises

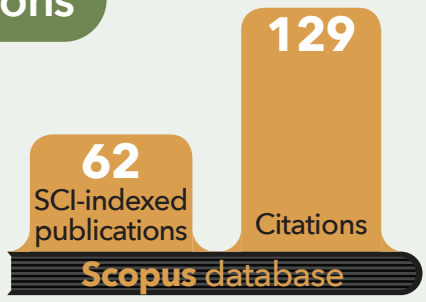
Facilitated **3** companies to invest over NT$24.55 million

Supported **3** enterprises in expanding employment, creating 16 new jobs

Important Academic Publications







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